

THE



OF

PHOTOGRAPHY.

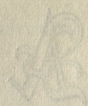
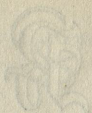
SECOND EDITION.

THE COLLODION PROCESSES.
PHOTOGRAPHIC PRINTING.
OUT-DOOR PHOTOGRAPHY.
PORTRAITURE.
STEREOSCOPIC PHOTOGRAPHY.
FAILURES, AND THEIR CAUSES.
ETC., ETC.

PUBLISHED BY
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1857.

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SECOND EDITION.

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INTRODUCTION.

It is proposed in the present little treatise, to give plain instructions in that branch of the photographic art, known as the "Collodion Process;" and it fortunately happens, that while this process is capable of producing more beautiful results than any other, the required manipulations are of a character so simple and easy, that with an ordinary amount of care, attention, and patience, the amateur must meet with success: we ask for his care and attention to our instructions, and hopefully promise, on our part, that his patience shall not be tested too severely by theories, technicalities, or other mysteries of photography.

The photographic pupil should begin at the general and then proceed to the particular: thus, he should gain a superficial knowledge of the principal causes and effects involved in the process, and afterwards carefully follow the manipulatory details. We purpose assisting him in this proceeding, by a slight sketch of the art, before practical instructions are laid before him.

We will not rake up our Greek to show that all pictures produced by the agency of light are properly named "Photographs;" the term, however, is commonly applied to finished

light-drawn pictures on paper ; those on silver plates are called "Daguerreotypes," and those on glass and collodion "Xylotypes," or "Glass Positives."

Photography is strictly an artistic application of chemistry, and the photographer soon becomes—to a greater or smaller extent—a practical chemist. Nitrate of silver is the first chemical which comes under his notice, and it is the most important of all the compounds which he uses ; a strong solution of this salt brushed over a piece of white paper and dried in the dark, assumes, when exposed to sunlight, a grey, and finally a brown colour ; and if any opaque substance be placed on a part of the paper during the time of exposure, it will be observed that such part being protected from the action of the light, a photographic outline copy of the opaque substance will be obtained. Now the principle involved in this fact,—the reduction or decomposition of the nitrate of silver—regulates and determines the action of nearly all the various photographic processes : thus, in the collodion process, a fine kind of transparent paper is formed on a plate of glass, by pouring on it an ethereal solution of gun cotton and iodine (termed iodized collodion) ; the ether evaporates and leaves a thin film on the glass, which is plunged into a vessel containing a solution of nitrate of silver ; the nitrate immediately produces a surface similar to, but more sensitive than, that of the prepared paper first spoken of ; the sensitive film, still adhering to the glass plate, is then placed in the focus of a camera obscura, and an image or shadow of some object thrown on its surface ; the light reflected from this object rapidly causes a surprising but invisible change,—the image in the camera has impressed itself on the sensitive surface of the collodion film, but the impression being latent requires development, and this is effected by pouring a chemical solution over the surface of the impressed film ; the image very soon makes

its appearance, and only requires to be "fixed," or secured from the further action of the light, when the photograph is finished. A picture thus produced, when held over a dark object, and seen in the ordinary manner by reflected light, has its lights and shadows properly disposed, and is a perfect copy, save in colour, of the image formed in the camera obscura; but when viewed as a transparency, the lights and shadows are reversed; supposing that a portrait of a gentleman had been taken, the collodion photograph seen by reflected light would show a white shirt-front and a black coat, this would be a "positive" photograph; but the same glass held up to transmitted light, would present the appearance of a black or opaque shirt-front and a white or transparent coat, this would be "negative." In practice it is found, that the best negative by transmitted light, makes the worst positive by reflected light, and *vice versa*; a slight difference, therefore, is required in the treatment of the sensitive plates, the principle remaining the same.

Supposing that the process just epitomized, have produced a perfect positive, it has black varnish or velvet placed on one side of the glass, and its slight negative character destroyed; on the other hand, if the picture be negative, its value lies not in itself, as is the case with a positive, but in its power of producing an unlimited number of positives on paper; this by a process called "printing." Paper is prepared in the dark with chloride and nitrate of silver, and when dry, the negative is placed on a sheet of the sensitive paper, fixed in a glazed frame, and then exposed to daylight, which passing easily through the most transparent parts of the negative, blackens those portions of the paper immediately under them, and forms the shades of the photograph, while the lights are preserved by the opaque parts of the negative; when properly printed, the paper photograph is taken from the printing frame and fixed by removing the unaltered and now

unnecessary chemicals from the surface of the paper. The process can be repeated on other papers with the same negative, until a sufficient number of prints is obtained.

Having briefly glanced at the collodion processes in all their simplicity, in order that the tyro may be in some way prepared for what is to follow; we pass at once more deeply into details, premising, that in aiming at excellence the operator must strictly follow the instructions, omitting nothing because he may think it unnecessary, or because the reason for it is not very apparent; he may rest assured that our desire to simplify the process has not permitted us to set down anything which we are not certain is absolutely necessary to success.

COLLODION PROCESSES.

PREPARATORY ARRANGEMENTS.

It is the fashion, and a good one too, for the ambitious of photographic honours, to purchase complete sets of apparatus; much trouble and expense is spared by this proceeding, as all unnecessary apparatus and badly-matched tools are avoided. We can imagine the rather anxious receipt of the neat box with its "complete set;" the contents are admiringly overhauled, and there is, mingled with just the faintest suspicion of failure, a strong feeling of hope for the photographic future; but here, just at the onset, a difficulty presents itself,—“What shall I do first?”

Begin by preparing a temporary dark room; this may easily be made from an ordinary lumber-room or bed-room; supposing the latter, and that it have but one window, have a double black calico blind made, rather larger than the window, and furnished with a few loops along the hems to fasten to corresponding hooks round the window-frame; at the lower end of the black blind, a piece measuring about two feet square should be cut out, and its place supplied with three thicknesses of bright yellow calico; on fastening the blind over the window and closing the door, the room should not admit a gleam of

light, excepting that proceeding through the yellow calico; the edges of the blind require especial attention, as a very slight pucker, which would admit a few rays of daylight, would be fatal to all collodion operations; the yellow calico will give an ample supply of light to enable the operator to see what he is about, and will not have the slightest injurious effect on any of his most sensitive preparations; a large table to work on, a smaller one for delicate apparatus or preparations, and a good supply of clean water, will complete the arrangements, and on the first bright day a commencement may be made.

According to the convenience of the amateur, this arrangement for a dark room may be modified or entirely altered; the essential part is freedom from daylight when the plates or papers are in a sensitive state: candlelight is objectionable, unless the flame be screened by yellow glass or calico.

We should recommend the amateur to make his first essays on paper, by copying leaves, lace, and engravings on chloride of silver in the copying frame, as detailed in the section on "printing;" the advantage is in the simplicity of the process, and the manner in which it prepares the photographer for more difficult operations; it also makes him familiar with the action of several important agents in his art; still we do not insist on printing being his first step, let him secure a friend for a sitter, and, if he please, at once perpetrate a portrait. In any case, it will first be necessary to prepare the chemical solutions required for the process in which the essay is to be made; an account of these solutions, with the manner of preparing them, if introduced in this place, would by their complication, tend rather to confuse than instruct; they have, therefore been arranged by themselves at the end of the Pamphlet, and can be referred to as required.

POSITIVES ON GLASS.

PREPARATION OF THE GLASSES.

CHOOSE from the stock of glass plates those which are free from scratches, specks, and other flaws, and which fit properly into the various sized frames ; let these glasses have the edges ground or roughened with coarse emery cloth, or the stick of composition made for the purpose, and which is easily procurable ; the glasses may then be well washed with common water and dried with a clean cloth.

Make a thick paste by mixing together about equal quantities of liquid ammonia, tripoli powder, and spirits of wine, and then reduce it to the consistency of cream by the addition of water. Supposing that a dozen glasses are to be cleaned, after the first rough wash, take a small piece of rag or cotton wool, dip it into the tripoli mixture and well rub it over both sides of the glasses, which are then placed on a shelf and leaning against the wall ; when the last plate is done, begin again with the first one which is now coated with dry tripoli. With one of the clean linen cloths, kept specially for this purpose, rub off the tripoli and well polish the first glass, and then proceed with the others ; they are now half-cleaned, and can be kept in a box until required for use ; the last polish is given just before using : one side is again carefully rubbed all over with the tripoli mixture and immediately wiped off with a soft clean cloth, then the surface is polished with a clean silk handkerchief—whose legitimate occupation is gone,—or with a large and clean wash-leather. From the commencement of cleaning the glass, the

fingers must avoid touching the surface—it can be held in the hand (itself clean and dry) by its opposite edges until the final polishing is to be given, when it can be fastened in a plate-holder or laid flat on a clean piece of paper and finished; breathe over the polished glass, and observe if the breath settle on it and evaporate evenly; if it do, the glass may be considered as properly cleaned, and with one more polish, when free from the moisture, can be used immediately; but, if when breathed on, the glass show any streaks or irregular marks, the polishing must be repeated until such streaks and stains disappear; it is almost impossible to use too much care in this matter, as a good picture cannot, by any chance, be made on a glass which is not chemically clean.

COATING THE PLATE.

At this stage of the process there are required, a tall narrow bottle containing the positive iodized collodion, an oblong gutta percha vessel nearly filled with the positive nitrate of silver bath, and a slip of glass, called a dipper. The manner in which the collodion and the silver bath are made, will be found with the directions for the manufacture of the various solutions used in the processes. (See "Solutions for glass positives.")

The upright gutta percha trough is improved by being provided with a loose fitting cover, which can be made out of gutta percha or cardboard and brown paper; it serves to keep out both light and dust, and allows one to let daylight into the dark room while the plate is being made sensitive in it,—a proceeding sometimes necessary, but generally dangerous. The dipper should project about an inch above the bath, when placed in it, so that it can be easily felt in the obscure light and also be a support to the cover.

Clear from the neck of the collodion bottle any dried pieces of collodion which may be attached to it, and holding one corner of the polished glass by the thumb and first finger of the left

hand, pour on the centre of its cleanest side rather more than a sufficient quantity of the iodized collodion to cover its surface; then slightly incline the plate, that the thick fluid may flow evenly over it from corner to corner, and the superfluous collodion be returned to the bottle from the corner last covered. It is desirous that the film formed on the glass by the evaporation of the ether, should be perfectly clear and structureless, and in order to produce this, it is necessary to coat the plate carefully, and with the "knack" which a little practice will soon afford. Never let the collodion run twice in one direction, but let it flow steadily and without jerking or hurry, and in pouring back the superfluous quantity into the bottle, bring the glass gradually from its horizontal to a vertical position, allowing the corner nearest to the bottle to rest on its neck and dip down into it: when the collodion begins to drip slowly, oblique lines will form on the plate, but by slightly altering its inclination the lines will coalesce and disappear. It is as well to run the collodion round the thumb without coming in contact with it, as the mere trace of any foreign substance washed from it, and mixed with the collodion on the plate, would certainly cause blemishes to appear when the picture came to be developed. We have said that the collodion film should be formed without hurry, still it is advisable not to waste too much time over it; a plate can be very deliberately coated in from five to fifteen seconds.

Before the plate is made sensitive, the film is allowed to "set;" the ether and alcohol in the collodion very rapidly evaporate, and in a short time would leave the film perfectly dry and unfit for use; on the other hand, if the plate were immersed before the film had properly set or partially dried, the collodion would be decomposed, and stains and other nameless phenomena would develop themselves.

The time required for the setting of the film varies with the temperature; in very hot weather, the plate can hardly be immersed in the silver bath too soon after coating; in winter, from a minute and a half to two minutes may be allowed, probably the average is about half a minute.

MAKING THE PLATE SENSITIVE.

IN following the preceding directions for cleaning and coating the glasses, one corner of the black blind may be looped up and daylight freely admitted into the dark room, but before another step is taken every ray of white light must be excluded. When the collodion film has set, draw the glass dipper nearly out of the nitrate of silver bath, and place the glass on it with its coated side outward and its lower edge resting on the cross piece cemented to the end of the dipper; then, taking the upper part in the hand, steadily, but rapidly, immerse the dipper, with the supported glass, in the silver bath and put on the cover. As the plate has to remain for several minutes in the bath, the time can be well employed in arranging the sitter, if a portrait have to be taken; this being done, as described further on, return to the dark room, and closing the door, draw the dipper cautiously up, that the excited plate may not fall off, and by the yellow light carefully, but quickly, note the appearance of the film, and then return it to the bath; it will be observed that it has lost its great transparency, is of a yellowish white colour, and comparatively opaque; this is the result of a chemical action exerted by the components of the silver bath and the iodized collodion: the iodide of potassium in the collodion is a colourless, soluble salt, but immediately it comes in contact with the nitrate of silver solution, it is decomposed; so also is the nitrate of silver to the extent of the decomposition of the iodide of potassium, an exchange of parts is effected,—nitrate of potash formed in the bath and iodide of silver in the collodion film. Iodide of silver is a pale yellow insoluble powder, and its formation and presence in the film is very clearly indicated by the colour and opacity which it produces. The non-chemical reader may desire to know why this mutual decomposition occurs; we must refer him to any elementary work on chemistry, where he will learn that

under certain circumstances, very many similar interchanges and decompositions of compound bodies take place, and that such changes are governed by the "law of affinity:" it will be sufficient for him at present to know that he has a result of this law before him—a film of collodion containing iodide of silver and covered or wetted with a solution of nitrate of silver.

In addition to the change in the constitution of the film, there is another circumstance which requires especial attention before the plate is used: it will be found that after one or two minutes' immersion in the bath, on drawing up the plate, the fluid will not run evenly over it, but will flow in streaks and the film appear oily, but after a longer soaking the long waving streaks vanish, and the solution runs evenly over the plate; until this appearance is seen, the plate must on no account be used; the effect can be facilitated by drawing the plate up and down in the bath for three or four times. The time that the plate should remain in the bath is dependent on the state of the film and the temperature of the room; perhaps four minutes is the minimum time allowed, but a longer time, say to the extent of a quarter of an hour or more, is seldom hurtful; on the contrary, the sensitiveness is improved by it,—the only drawback is in the fact that minute holes or specks are very frequently found in the film after long soaking in the silver bath.

EXPOSURE OF THE PLATE.

PLACE the camera on a suitable stand and point the tube containing the lenses in the direction of the sitter, a reduced and inverted portrait will then appear, more or less distinctly, on the ground-glass at the back of the camera, and the miniature will become larger or smaller as the distance between the camera and the sitter is diminished or increased; with every variation of the distance, a corresponding adjustment of the camera and its lenses is required in order to produce on the ground-glass an

image perfectly sharp and distinct; this is effected by drawing out or pushing in the inner box of the camera, so as to alter the distance between the lenses and the ground-glass; when the image is tolerably clear, then by turning the pinion attached to the brass tube, a very accurate adjustment of the focus can be obtained.

In focussing use a dark cloth, sufficiently large to cover the back of the camera and to draw over the head and shoulders; with the eyes thus protected from external light, a very distinct image of the sitter can readily be focussed on the ground-glass.

Return to the dark room, draw up the plate from the silver bath, and observe if the solution run evenly over the film; if it do not, move it up and down in the bath as before directed. When the oily appearance is gone from the plate, remove it from the dipper, and let the excess of silver solution drain from one corner into the bath; then place it in one of the camera slides, previously fitted with the proper sized frame for the glass just prepared. The uncoated side of the glass should be outward, and facing the door of the dark slide; on closing this door the spring attached to it presses against the back of the prepared glass, and keeps it firmly in its place. A cursory examination of the ground-glass and the dark slides will show that the surface of the prepared plate, when placed in the latter and fitted into the camera, will be situated in exactly the same place that the rough side of the glass occupied when the image was focussed; consequently all that is now required is to draw out the frame carrying the focussing-glass, and to substitute the slide which holds the sensitive plate. Place the brass cap over the lenses and draw up the sliding door in the dark frame, then—having requested of the sitter as amiable an expression as is consistent with perfect immobility—remove the brass cap. It is quite plain that an image of the sitter is immediately thrown on the surface of the collodion film, and in a very short time the desired but invisible effect is produced. The time of exposure in the camera varies with the power of the light, the dress and complexion of the sitter, and the sizes and focal length of the

lenses; it is, therefore, quite impossible to give any reliable rule on this point without being acquainted with every circumstance. The process being an exceedingly quick one, amateurs are very apt to over-expose the plates; it would be well then to commence by giving a short exposure, say from one to four seconds on a bright day, and to correct by further trials the failures caused by under-exposure; these are easily distinguished in the development.

When it is judged that the plate has been sufficiently exposed, replace the cap on the lens-tube, slowly push down the sliding door of the frame, and remove it at once to the dark room for development. There should be no unnecessary delay between exposing and developing the plate, as the wet film soon gets partially dry and gives rise to patches and transparent spots on the picture; the same effect is produced if any considerable time elapse between exciting and exposing the plate.

DEVELOPING THE PICTURE.

On returning to the dark room, place near the yellow light and rather beneath it, a pan or large basin to catch the waste chemicals and water which are going to be used; on the right of this, have ready to hand a bottle holding the positive developing solution, a small glass measure or other lipped vessel recently cleaned, another bottle containing the fixing solution, and a jug holding a quart or more of clean water.

Put a little of the developing solution into the glass measure — for a plate 4 inches by 3 about half-an-ounce will be sufficient. Remove the exposed plate from the dark slide, and, holding the glass by one corner in the left hand and over the waste pan, pour on the film a sufficient quantity of the developing to cover it, but not run over. It should spread over the surface without stoppages and run to the edges very quickly, or indelible stains will shortly appear. Do not throw on the developing

violently and in one place, but pour it on in a stream near the upper edge of the plate, moving the hand at the same time, so that having begun pouring at one corner, the plate may be filled when the hand has reached another. By these means the spreading of the solution is facilitated and an ugly blot avoided—the latter inevitable when the developing is thrown forcibly on one spot.

The film being covered, a faint outline of a figure soon appears, which rapidly grows more intense, and gradually the details are brought out. The greatest attention is required at this stage, as a good picture can be so readily spoiled by over or under development; it is against the former that the amateur must especially be upon his guard. The best plan is not to develop for the shadows, but to look well after the lights; first the whitest objects appear, such as a shirt-front or collar, then the face and hands, the rest of the plate remaining yellowish and unaltered; directly the detail in the shadow-side of the face appears, stop the developing action by pouring over the plate plenty of clean water and thoroughly washing away (into the pan) every trace of the developing solution. Now hold the plate up to the yellow light and observe the appearance of the picture; the face and hands should show most of the detail, but very lightly marked, and the densest parts have but little opacity; the darkest shadows should not be made out at all, but present the yellow colour of the unchanged iodide of silver. If the plate be well washed, daylight will not have any further action on the film, and the blind may again be looped up and the picture fixed.

An under-exposed positive is known by the slow action of the developing solution; the whites come out very strongly, but the half-tones are invisible; by continuing the development for some time, more detail is gained, but the transparency of the shadows is sacrificed—they become covered with a brownish and speckled deposit, and the picture is spoiled.

An over-exposed plate has the image formed on it immediately that the developing solution is poured on; the picture shows at

once all the detail, but is flat and weak, and further development does not tend to strengthen it.

FIXING THE PICTURE.

STILL beholding the plate horizontally by one corner, pour the fixing solution quickly over it, in the same manner and with the same precautions that the developing solution was used. The yellow, unaltered iodide of silver in the film is very rapidly dissolved away, while the opaque parts remain unchanged. Directly the last trace of the yellow iodide disappears, wash off the fixing from the film with plenty of clean water, at least a quart for the smallest plate, and a quantity proportionate to the larger sizes. It is very necessary not to spare the water, as a small quantity of the cyanide left on the plate would soon eat away the picture: for the same reason it is essential that the fixing should be washed away immediately on the disappearance of the yellow opacity in the shadows; on delaying the rinsing, the cyanide gradually clears off the delicate shadows,—the charm of all good photographs,—and soon reduces the picture to a patchy daub.

In washing the plate—both before and after fixing—some little attention is required to the manner of doing it, otherwise the film will be apt to split from the glass and ruin the picture; the stream should be sent in different directions, shifting the position of the plate as the water is poured on, and taking care that it does not get under the edges of the collodion.

After washing the picture, which is now quite unalterable by the strongest light, place it over a black cloth and examine its appearance; the blacks should show the cloth through, undimmed by the slightest cloudiness or opacity, and the whites should be clear, deep, and have their gradations of tone fully preserved; if otherwise, there is a fault somewhere, and further trials must be made.

Neglect in any stage of the collodion processes almost

invariably leads to failure, but the most careful sometimes arrive at the same goal: we have, therefore, drawn up a list of the most common cases of failure and arranged them in columns, one the effect and the other the cause,—the latter leading, it is hoped, to the remedy. Still, not to break the natural order of the process, we will first finish the portrait just supposed to have been taken, and which we are willing to believe is a great success.

FINISHING THE PICTURE.

AFTER washing, the plate should be placed on a clean shelf free from dust, the film turned to the wall, and the upper edge of the glass resting on it; in an hour or two it will be dry. If time be an object, the glass can be gently heated over a spirit lamp or before a fire, until the film is free from moisture; it can then be varnished, if it be thought necessary. Amber varnish may be poured over the film and allowed to soak in for a few seconds, and the excess returned to the bottle, taking care that the lines or channels of the varnish run into each other and dry evenly. A good deal of practice is generally required to do this well, and after all the varnishing is of doubtful advantage.

The picture now requires "backing up:" pour on the plain side of the glass some black varnish, and tilt it gradually from corner to corner until the plate is nearly covered; minding that the sable fluid does not run over the edge and on the face of the picture, to do which this varnish seems to have a perverse inclination; now lean the plate against a wall to dry, which is done in an hour or less, and the photograph is finished. It can be readily tinted by stippling on dry colours with soft brushes and using moist colour for the high lights and any small effective touches.

The picture thus finished is reversed, as regards position; that which was to the right hand of the sitter will appear to the

left in the picture, in fact just as we see ourselves in a looking-glass. If this be objectionable, the black varnish can be spread over the collodion side of the glass, instead of on the plain side; but as it is apt to crack, and by other means destroy the picture, even when used over the transparent varnish, it is a plan which cannot be recommended. Some photographers use black velvet for backing up their positives, and it possesses many advantages; a piece can be cut of the same size as the plate, and placed in contact with either side; it is then mounted under glass, to secure it from the action of damp air, and the picture is complete.

FAILURES WITH GLASS POSITIVES.

THE APPEARANCE OF THE PICTURE.

1. The plate has one or more large curved marks (apparently between the film and the glass), or has a cloudy mottled appearance which shows very plainly in the transparent shadows.

2. Very small transparent spots are spread more or less thickly all over the plate.

3. Transparent spots of different sizes, fewer in number than in the last case and not regularly spread.

THE CAUSE.

1. The glass was imperfectly cleaned; the cause of the circular smears is known by their following the direction of the hand in polishing the plate.

2. Either left too long in the silver bath, or too long in the dark frame, before or after exposure.

3. Dust or other impurities in the collodion or silver bath; particles of sawdust from the camera or its slides sometimes fly on the plate and prevent the light acting on the film beneath.

4. Clear daubs of half-an-inch or longer, running in one direction over the plate.
5. One black patch (transparent), most likely circular in form.
6. The plate has eccentric markings, something like comets, with specks at the heads and with tails of various lengths.
7. One or more fine lines running nearly straight across the plate.
8. The corners of the plate have opaque stains; perhaps the edges also.
9. Irregular stains over the surface of the film,—not proceeding from a dirty glass.
10. The picture is free from stains or other similar blemishes; the blacks are clear, but the whites are flat, and the shadows too heavy.
4. Never jerk down the slide of the dark frame, it generally splashes the drainings of the plate over the film.
5. The developing solution poured on with force and in one spot.
6. The collodion used too soon after mixing; the small particles sometimes seen on iodizing the collodion have not had time—some to redissolve and others to settle to the bottom of the bottle.
7. The plate immersed in the bath, not with a continuous motion, but stoppages made,—every stoppage causing a line.
8. A dirty slide and the plate not well drained. The corners of the slide can be varnished with advantage, or blotting paper placed between the edges of the glass and the supporting corners.
9. Most probably the developing solution was not spread over the surface quickly, and thus its action was unequal.
10. Under-exposed or under-developed — most likely the former.

11. Similar to the last case, with the lights nearly bright enough, but the deepest shadows heavy and speckled all over.

12. The lights flat and without detail, and the shadows wanting depth.

13. A light film all over the picture—destroying all contrasts.

14. There is a greenish blue tinge either on a part or all over the plate.

11. Under-exposed and over-developed.

12. Over-exposed, over-developed, or both together.

13. If not greatly over-exposed, there is daylight in the dark room; the slide or camera also may not be light-tight.

14. The developing solution not well washed from the plate previous to the application of the fixing solution; or bad collodion.

NEGATIVE PROCESS.

ALTHOUGH the process about to be described is very similar, as regards manipulation, to that adopted for the production of positives, yet the results being of so different a character, it will be necessary to show where the difference exists, and to add certain directions respecting the silver bath, the development, &c., tending to simplify and make certain the process under notice. It must be borne in mind that no time or trouble can be misspent in making a good negative, as all its excellences or imperfections are transferred to every paper copy printed from it.

THE NEGATIVE COLLODION.

THE glass being cleaned as described in the positive process, coated with negative collodion, and immersed in the negative silver bath, has now to be exposed. The conditions which regulate the proper exposure are continually varying, and to a much greater extent with negatives than with positives: the collodion being more highly charged with iodine, more readily decomposes, and this decomposition greatly influences its sensibility. Collodion, within two hours after its being iodized, is highly sensitive, and it is possible on a sunny day to take very satisfactory instantaneous pictures by using it; on the other hand, by using iodized collodion a month old an amount of exposure would be required from five to ten times longer than

that for another sample recently mixed. It might be supposed that the great sensibility of new collodion would be of advantage in every instance, but it is not so; it should be used only in such cases, where the amount of light reflected from the object is small, or where the exposure must of necessity be short, as with copies of old paintings or bronzes, and portraits of children. Old iodized collodion is indispensable for taking satisfactory copies of light engravings and for views; the reason for this is found in the fact, that the newer the iodized collodion the greater the liability of the picture to contract, with other defects, a certain mistiness, called "fogging,"—the film is so extremely sensitive that, with a strong light or bright object, the diffused and reflected light in the camera act all over the plate, and thus the purity of the deep shadows is destroyed; with old collodion, this cause of fogging—one of several—never occurs. With the knowledge of the varying sensibility of the collodion, the operator has the power of choosing that most suitable for his purpose; he should keep the plain collodion and the iodizing solution in separate bottles, and mix them as required with reference to the age at which he intends to use the negative collodion,—within a few hours for quick portraits or copies of very dark objects, from twelve hours to a week old for ordinary work or portraits, and from three weeks to two months old for sunlit views and copies of very bright objects, where the lengthened time of exposure is immaterial.

It is quite impossible to give even a general rule of any service relative to the required time of exposure for negatives, it is only experience and attention to the symptoms of over or under exposure, as seen in the development, that can afford the operator any valuable assistance on this important point. Negatives always require a longer exposure than positives; the light, the lens, and other circumstances being the same, a negative might require from three to five times as long an exposure as a positive, and this with the negative collodion rather recently mixed.

THE NEGATIVE BATH.

It is highly probable that the bath made as directed further on (see "Negative Solutions"), will yield, at starting, very excellent results, but it is possible that it may not; it is certain that, after it has been used for a considerable time, it will deteriorate and require correction. It is necessary then to be able to ascertain the quality of the negative bath from the first, and to have the means of preserving it in good working order—nothing more simple, nothing more important. Take a piece of blue litmus paper, sold in little slip books, and immerse one end of it in the negative silver bath; if it turn reddish very rapidly, the bath is acid—much too acid for use; if the litmus assume a faint red appearance after an hour's soaking, the bath would most likely give fair results; but to produce the best effects, the nitric acid, which causes the reddening of the test paper, must be neutralized. Supposing that a pint of the silver solution have to be corrected—add to it four drops of strong liquid ammonia and shake it up; unless the bath were unusually acid, these four drops will be quite sufficient, not only to neutralize the acid, but to leave the bath slightly alkaline: now as an alkaline bath is highly objectionable, it is necessary to add a few drops of acetic acid (say two drops at a time) until the solution becomes neutral, or what perhaps is safer for the beginner, *very slightly acid* with the acetic acid. By using the blue or red litmus paper, the state of the solution can easily be determined; acids redden the blue slips more or less rapidly as the acidity is greater or less; the red litmus paper is made by soaking the blue in a weak solution of acetic acid and then drying it; a slip of this immersed in an alkaline liquid has its blue colour restored. If on testing a new bath it be found to have an alkaline reaction, ammonia need not be added to it—simply a

few drops of acetic acid, sufficient to give the blue test paper a red tinge after an hour's immersion.

An old silver bath is sure to be acid, and besides requiring correction for nitric acid, will probably be weak of silver; if not in very bad condition, and too small in quantity to pay for the trouble, add some nitrate of silver to it (about ten grains to every ounce), and then test and correct it as described.

From time to time, as the bath loses by use, it will require additions to maintain both its strength and quantity; it will be found sufficient to add occasionally a few ounces of distilled water, in which is dissolved nitrate of silver thirty grains to each ounce.

DEVELOPING THE NEGATIVE.

WE have said, that with the exception of a lengthened exposure and the substitution of negative for positive solutions, the two processes are conducted in precisely the same manner; but a very material difference in the manner of operating occurs when the intended negative comes to be developed.

For a plate measuring five inches by four, use about an ounce of the negative developing solution; pour it into a clean measure and, having carefully excluded daylight from the room, remove the exposed plate from the dark slide, hold it near the yellow light by one corner, with the face up, and pour the developing solution quickly all over the surface; any pause in the flowing of the solution will form lines and stains on the finished picture, so it is necessary to run it over from side to side very rapidly by tilting the plate in different directions until it is well covered.

In developing positives, the general fault with amateurs is, that the development is carried too far; but with negatives, under-developing is the common error. In order to avoid both evils, hold the plate, with the solution on its surface, in such a

position with respect to the yellow light, that the image may be seen as a transparency and its negative character examined, and then again by altering the position of the hand, the surface of the film only can be brought into view; the development can by these means be advantageously watched and stopped at the proper moment: as an instance, and presuming that a correctly exposed plate is being developed, first the high lights and whitest parts appear, and then gradually all the details; pour back the developing into the measure, hold up the plate between the eyes and the yellow light, and look through it; the lights will appear more or less opaque and the details faintly sketched in; restore the plate quickly to its horizontal position, and again pour on the developing, now getting discoloured; soon the picture will seem to be spoiling by the lights getting flat and obscure, but the negative is quite safe, so long as the very darkest parts, such as the shadows in a black coat remain unaffected by the solution and still retain the yellow semi-opaque appearance which every part of the film presented before the development. It is as well to keep the solution while on the plate constantly moving, to prevent unequal action and any decomposed particles from settling on the plate and causing spots: on this account, pouring the solution on and off the plate several times is of advantage, and further, allows one to examine the negative by transmitted light as explained. The negative is properly and sufficiently developed when those parts of the picture which were white in the original, are almost perfectly opaque in the negative—the darkest shadows remaining yellowish and unaltered under the influence of the developing solution, and the gradations of tone fully preserved.

The development of a plate which has been properly exposed, is a much more simple matter than would appear by the description; indeed, it is almost difficult to spoil utterly a picture which has been nicely timed; on the other hand, any amount of verbal instruction would but imperfectly prepare the amateur for meeting and overcoming the difficulties of over and under exposed negatives; still there are one or two facts, the knowledge

of which with a little practice and a few failures, will be of great service to him.

Negatives which have been very much under-exposed are useless; they present the appearance of capital pictures when seen as positives, but as negatives the contrast of light and shade is too violent; in the vain attempt to bring detail into the shadows, the lights are, as it were, clotted; and the longer the development the greater the failure; but when the time of exposure has not been much too short, the picture may often be saved by using a large quantity of the developing solution frequently changed; the image is formed by the precipitation of metallic silver on the parts of the plate which should be opaque, and this metallic silver is produced from the nitrate of silver already on the film: now if the nitrate be weakened by using an unusually large quantity of developing solution, the opacity, which is most to be dreaded with under-exposure, is delayed and time given for the half-tones to develop themselves.

A negative which has been greatly over-exposed, bursts into sight at once on the developing solution being applied, and the image gets fogged all over immediately; there is very little contrast, the half-tones which photographers fall into raptures over, are there in abundance; in fact it is all half-tone, no coaxing development can save it; but when the exposure has been within double the proper time, there are hopes of its redemption. Directly the image starts into view, which it will do showing all the details at once faintly and with a reddish tint, wash off the developing by pouring on at least a pint of clean water; then take some fresh developing, and add to it about one fourth part of nitrate of silver solution (30 grains to the ounce) pour this mixture several times on and off the glass, the red tint will leave the negative, which will turn black and be strengthened by this mode of procedure. If it still appear too weak and want contrast, the plate can be again washed and again treated with a fresh mixture of silver and developing: a fresh mixture, as the compound of silver and developing

decomposes almost immediately, and it is necessary to use it before the decomposition takes place.

FIXING AND FINISHING THE NEGATIVE.

HAVING sufficiently developed the negative image, wash off the chemicals with plenty of clean water, as described in the positive process, and also in the same manner pour on the cyanide fixing solution; this will soon clear off the iodide of silver from the shadows, but will leave intact the deposited silver which forms the picture. With another unsparing application of water to remove the cyanide, the fixing is completed. It is advisable not to leave the fixing solution too long on the plate; directly the yellow iodide is dissolved, it has done its duty, and its presence after that is likely to prove injurious.

Negatives require varnishing, otherwise the film is apt to get scratched in the printing process. When the plate is perfectly dry, pour on the collodion side some amber varnish, and coat the plate as if collodion were being used, returning the excess into the bottle in the same manner. The varnish dries immediately.

FAILURES WITH NEGATIVES.

(See "*Failures with Glass Positives*," Nos. 1 to 9, which apply equally to *Negatives*.)

THE APPEARANCE OF THE PICTURE.

1. The negative while wet is of a green tint by transmitted light, and not of sufficient intensity to print well.

THE CAUSE.

1. The bath is acid with nitric acid; it can be corrected as directed under the head of "The Negative Bath."

2. The picture is of a pale red colour; details plain but weak, and the whole negative uniformly flat.

3. Viewed as a positive, the picture shows very well, but as a negative the high lights are extremely dense, and there is no half-tone or drawing in the shadows.

4. Good as a positive; the shadows transparent, and the lights weak.

5. The picture is very dense all over; the shadows are not transparent enough.

6. The blacks are transparent, the whites extremely dense, and it neither looks well as a positive nor as a negative.

7. On holding the plate up to the light, stains like curtains or fringes appear; the same effect, to a less extent, is seen by reflected light.

2. Over-exposed; the redness is due to the acetic acid, either in the bath or the developing; it is a much healthier sign than the green tinge produced by nitric acid in the bath.

3. Under-exposed. Contrary to what might be expected, the shorter the exposure in the camera, the denser will be the negative; a longer exposure will soften down the great density of the lights, and bring detail into the shadows; a still longer exposure fogs the latter, weakens the former to too great an extent, and destroys the contrast which should exist in the finished picture.

4. Not sufficiently developed. A good negative seldom shows much distinctness as a positive.

5. This may print tolerably well, but very slowly; it is over-developed.

6. Under-exposed and over-developed.

7. Bad collodion; try another sample. The defect can be mitigated, but not altogether removed, by lengthening the time between the coating of the plate and immersion in the silver bath.

8. On developing, the picture becomes obscured by a dark, heavy cloudiness.

9. A foggy veil all over the picture, not produced by over-exposure.

8. Most probably the silver bath is alkaline; add to it one or two drops of glacial acetic acid.

9. The slides or camera are not light-tight, or there is too much light in the dark room. A similar effect is sometimes produced when the collodion has been very recently iodized, if the object copied reflect much light; in such a case, older collodion may be used, or the opening of the lens-tube made smaller by inserting a diaphragm. (See "Out-door Photography.")

PHOTOGRAPHIC PRINTING.

A NEGATIVE produced by the process just described would be useless, unless there were some method of transferring, and at the same time reversing, the impression obtained thereon. In principle the matter is simple enough, but the very different results, as regards quality of print obtained by different photographers, show that a considerable amount of taste and discrimination is required, in order to produce really first-rate impressions.

Having obtained a good negative, it would, perhaps, be too great a tax on the amateur's patience and forbearance to request him to put it aside and begin his printing with more simple subjects; but there will be no difficulty, if he have taken the advice given at starting, and will make printing his first step in the art.

A very strong solution of nitrate of silver, spread with a brush over white paper, is tolerably sensitive to light, and good copies of lace and other similar objects can be obtained by using it; further, it only requires to be soaked in warm water, in order to fix it. For general purposes this paper is not sufficiently sensitive, and by a little more trouble in preparing and fixing, papers can be made better in many respects and very much cheaper.

Take a sheet of the unprepared photographic paper—not the glossy albumenized paper—and cut it into the sizes required, marking with pencil the wrong side of the paper, that it may

afterwards be easily distinguished ; the wrong side is known by its having a sort of fine pattern—a very small check or network. We will suppose that there are a dozen pieces of paper to be prepared ; first, they have to be “salted,” an operation which may be performed by daylight, but in a room where there are no dust and “blacks” floating about.

SALTING THE PAPER.

IN a clean porcelain dish pour a pint of water, in which has been dissolved 300 grains of common table salt (chloride of sodium), immerse a piece of the paper face up in the solution, without fingering it more than is necessary ; take care that the salt water wets the paper in every part, air bubbles resting on the paper will cause blemishes on the print, these must be blown away or the water agitated by moving the dish until they disappear ; place the other pieces in the solution in the same manner, one over the other, until they are all in the dish ; then, taking them together by the corners, turn them all in a mass, so that the sheet first immersed shall be at the top, and the last piece at the bottom of the dish ; let them soak for at least five minutes, then take them out one by one, commencing at the top, and hang them up by one corner to dry. Pins will answer very well for hanging papers ; they can be thrust through one corner and stuck into a shelf, and so arranged that the sheets shall not come into contact with each other, nor one part of the same paper with another part. The salt solution can be put into a bottle and saved for future operations. The dish or pan in which the papers were salted, had better be kept for salting purposes only ; in fact, every vessel used in photography should be dedicated to one service only, and never put to any duty but its own.

There is a glossy kind of salted paper, prepared with white of egg, and called “albumenized,” which is much used for

views, the preparation of which it will be necessary to describe. As a matter of taste, it is a question whether the varnished appearance of the prints produced on it be not objectionable; there can be little doubt, however, that great sharpness of detail can be secured by its aid, and no doubt at all that it is particularly adapted, by its fine surface, for stereoscopic subjects.

Small consumers will find it most economical to purchase their albumenized paper ready made; but if a little trouble, and, probably at first, an inferior kind of paper are not objectionable, proceed thus:—Take the whites of several fresh eggs—the number according to the quantity of solution to be made—put them all together in a clean basin, and add an equal bulk of distilled or filtered rain water. If the paper be required very glossy less water can be used. To every ounce of the mixture add eight grains of the chloride of ammonium, and then whisk the whole of it into a froth with a silver or wooden fork; cover the basin from the dust and allow the froth to subside, which it does in about twelve hours, then pour off for use the clear portion of the fluid, and filter it through muslin.

The paper to be albumenized should be floated on the thick fluid for a short time, say a minute, and great care taken to prevent the formation of air-bubbles and dirty stains. Let the paper hang to dry in a warm place perfectly free from dust.

When dry, the salted papers, including the albumenized, can be kept in a portfolio for any length of time without injury.

EXCITING THE PAPER.

MAKE a solution of nitrate of silver, 40 grains to every ounce of distilled water, and mix at least sufficient of it to cover perfectly the dish intended to be used; then take a clean and dry porcelain pan, and pour the silver solution into it. Turn up one corner of a sheet of the salted paper, and, holding it by

the corner, let the opposite corner down upon the silver and gradually lower the hand, that the whole surface of the paper may be in contact with, and floating on the solution in the dish; the wrong or marked side should be uppermost and quite dry. At first the paper will be inclined to curl up at the ends, but after a little time they subside; then, taking the paper by the turned-up corner, half draw up the paper, and observe if it be free from air-bubbles, if not, by drawing it across the solution and blowing off the bubbles, they are easily got rid of. The paper should remain in the silver solution from three to ten minutes, according to the desired sensitiveness; floating for a short time will make it less sensitive, and the picture will be of a different tone than if it had been in contact with the silver for a longer period.

The papers should be made sensitive in a place where the daylight is obscure; they are not so extremely susceptible to the action of light as the collodion plates, but it is advisable not to expose them to its influence while they are being prepared. When the paper has been in the silver bath for a sufficient time, remove it carefully by the turned corner, and hang it up to dry in a perfectly dark place. Pins are too liable to produce stains in the corners when they are hanging by them, therefore another arrangement should be made; perhaps the small wooden clips or American clothes pegs are the best things which can be used: several may be slung on a cord, and one corner of the silvered paper clipped to each.

The silver solution can be used again and again for other papers, it only requires occasional strengthening with a few grains of nitrate of silver; that is, if the quantity made in the first place were considerable, otherwise most probably the quantity, as well as the quality, will require renewal.

The effect produced on silvering a salted paper should be known: common salt thrown into a solution of nitrate of silver causes a thick white cloudiness, or precipitate of chloride of silver; the same result is attained on the salted paper coming into contact with the silver solution—the white insoluble chloride

of silver is formed on the surface, and, to some extent, in the substance of the paper, and renders it much more sensitive to the action of light than paper prepared simply with the nitrate alone. It is found that the chloride papers reach their maximum sensitiveness when all the salt is decomposed—turned into chloride of silver—and there is also on the paper an excess of nitrate of silver.

It should be mentioned that floating the paper on the solution is not the only plan which can be adopted; many prefer using a brush to spread the silver solution over the paper; its principal, if not only advantage, is in the present economy of the nitrate of silver, as a very small quantity of solution can be made at a time and used to the last drop; its great objection is in its liability, in inexperienced hands, to cause streaks across the picture corresponding to the course of the brush in exciting the paper.

To use the brush, place the sheet of salted paper on blotting paper, and both on a smooth flat board; and then, having dipped the brush into the silver solution, brush it quickly, evenly, and in one direction all over the paper; in two or three minutes brush over it again, crossing the course taken by the brush on the first application; after about two minutes soaking, hang the paper up to dry, and proceed with others, if more be required.

The brush should be rather large and not bound with tin or brass, any of the inferior metals producing decomposition of the nitrate of silver; it must be kept extremely clean, which can only be effected by well washing it in distilled water after it has been used.

When brushing the paper is preferred to floating it, the silver solution must be made rather stronger than for the latter purpose, instead of 40 grains silver to the ounce of water, say 60 grains to the ounce for the brush, and in other cases, where the strength of silver is given for floated paper, add about fifty per cent. to the quantity of silver; in every instance it is supposed that the salting has been done by soaking or floating.

In order to produce variety in the tones of the finished prints,

different salts to that recommended, and different proportions are found useful; with a view to this, a selection of formulæ for printing papers is appended.

1. Salt with 20 grains chloride of barium dissolved in every ounce of clean common water, and when the paper is dry, float it on 40 grains nitrate of silver to every ounce of distilled water.

2. Salt with 10 grains chloride of ammonium to the ounce of water; silver with 45 grains nitrate of silver to the ounce of distilled water.

3. Salt with eight grains chloride of sodium to the ounce of water; silver, with 25 grains nitrate of silver to the ounce of distilled water.

4. Salt with five grains chloride of ammonium to the ounce of water, and, for one ounce of silvering solution, dissolve 30 grains of nitrate of silver in half an ounce of distilled water, add cautiously to it, a drop at a time, strong liquid ammonia, which will at first cause a brown turbidness, but by increasing the dose of ammonia and agitating the mixture, the precipitate will be redissolved; when this is barely effected, so that there is still a slight cloudiness in the solution, enough ammonia has been used; add sufficient distilled water to make up one ounce; the solution can then be used in the ordinary manner.

The silvered papers should not only hang to dry in the dark, but must afterwards be strictly preserved from the light until required for use, nor should their use be long delayed, as they have a tendency to spoil, even when kept carefully in the dark; their keeping qualities are proportionate to their sensitiveness, some of the most highly sensitive, as the ammonia-nitrate papers and others prepared with the strong solutions, get discoloured and unfit for use within forty-eight hours of their preparation, and few of them will remain in good condition for more than a week.

THE PRINTING FRAME.

WE will suppose that the first use to which the printing-frame is put is in copying a piece of black lace. Take the copying-frame into the dark room, or any place where the light is rather obscure, and place it on a table, glass downwards; turn back the pressure-bars, remove the hinged back-board, and clean the plate glass, then place on it, in the centre, the lace which is to be copied, on this a rather larger piece of prepared paper with its sensitive side in contact with the lace, and on the back of the paper a piece of velvet, cloth or similar soft material; replace the back and fasten down the bars; if the bars have springs on them the arrangement is ready for exposure, but some copying-frames are provided with screws instead, in which case they will have to be tightened in order to bring the sensitive paper and the lace into perfect contact; on turning up the glass side of the frame and exposing it in the best light at command, a change will very shortly be apparent in the sensitive surface, the margin of the paper, and those parts of it seen between the interstices of the lace, will gradually darken, until they finally assume an olive-green colour; when this colour is attained, the printing operation is finished.

The time required in printing, of course, depends on the light and the preparation of the sensitive paper; the exposure may range from ten minutes to twelve hours.

On removing the sensitive paper from the frame, a perfect copy of the lace will be found impressed on it, but it will appear as white lace on a dark ground; in fact, it is a paper negative. It will be evident, that if the print just obtained be kept in the light, that the white will gradually darken and the picture be obliterated; it therefore requires to be "fixed;" the fixing process is explained further on.

Leaves, feathers, and engravings can have negative copies taken of them in exactly the same manner as that just described. With an engraving, a little extra care is required; the back of it must be clean and not have any printing on it, and in order to get good copies the paper should be tolerably clear; some old prints which are yellow with age and mottled in the substance of the paper, cannot be successfully copied by superposition. The engraving should be placed with its back to the glass of the pressure-frame, and its face in contact with the sensitive side of the prepared paper, which latter may be a little larger than the engraving, to allow a margin to be seen during its darkening in the light; when this margin has been quite bronzed in the sun, one of the pressure-bars can be undone, one of the hinged doors turned back, and a hasty glance taken at a part of the photograph. It is necessary to overprint in the copying, in order to allow for the fixing process, which lightens the prints to a considerable extent. If the copy of the engraving in the white parts be much darker than the original, it is probably printed sufficiently, and can be removed from the frame and fixed, but if it be not dark enough, the door and bar can be replaced, and the frame again exposed to the light; the engraving is supposed to be fixed in the centre of the copying frame, so that when one of the bars and one of the hinged doors are opened, the pressure of the other bar keeps the engraving and the prepared paper from shifting; the half of the copy which has been looked at, falls into its former position when the arrangement is fastened up again; still it is advisable not to open the frame oftener than is necessary.

In order to make *fac simile* copies of the engraving, the paper negative, after fixing, washing, and drying, has to be treated in precisely the same manner as was the original from which it was produced; it is put into the frame with the plain side to the glass, and its printed side to the sensitive paper, and this, when exposed, will give a positive copy of the engraving.

In printing from negatives on glass, place its uncoated side in contact with the plate glass of the frame, and the collodion side next to the silvered side of the prepared paper, on the paper the

cloth or velvet, and the whole pressed tightly together by the back-board and bars of the copying frame; the progress of the printing can be occasionally watched by opening one half of the frame as described. As a rule, it is necessary to overprint; the extent of the overprinting depends on the subject and on the manner of fixing, but a few trials, and the appearance of the finished picture, will afford the most valuable lessons in the art of printing.

FIXING AND TONING THE PRINTS.

IN the early days of photography, the greatest impediment to its progress was the difficulty of securing the photograph from the action of the agent which produced it, the light-drawn picture could not be exposed without being obliterated by the darkening of the light parts of the photograph. Something was wanted which, by dissolving away the chemicals in the unaltered parts of the picture, would prevent further action of the light. Many chemical solutions were known which had this dissolving power, but they had also the unfortunate property of dissolving the darkened parts also. After many chemicals were tried it was found that a solution of hyposulphite of soda was a perfect solvent of the white chloride of silver, but had scarcely any effect on the reduced silver forming the dark parts of the picture. With the knowledge of this fact, the operator's course after printing his photograph is very plain; he steeps the print in a solution of hyposulphite of soda, then washes it to remove the "hypo," dries it, frames it, and then—admires it!

To a pint of water add three ounces of hyposulphite of soda, when the crystals are dissolved the simple fixing solution is ready for use, and photographs may be fixed in it in ordinary daylight. On immersing a print in this solution, the chloride of silver in the whites is presently dissolved, the dark parts are lightened and a peculiar and rather disagreeable red colour given to the photograph. Now it is found, that after the hypo bath has been

in active use for some time, and about thirty or forty prints, fixed in it, that it begins to possess another property besides that of fixing; the newly prepared mixture gave none but red prints, but the old solution tints the photograph to any desired tone, from a warm brown to a greenish black, according to the time that it is left in the hypo.

The toning property of the hypo bath can be given to the solution at first, by mixing with it some nitrate of silver; dissolve 60 grains in an ounce of distilled water, and add it, a little at a time, to the pint of hypo, shaking the mixture between each addition, that the yellow precipitate may be readily dissolved. The colouring or toning power of this solution will be attained in some twenty-four hours after mixing.

Prints should not remain in the hypo for a shorter time than half an hour, and it will be safer to let them be immersed for a longer time,—say an hour. The operator must be guided by the appearance of the print; when it is lightened sufficiently, is of a good tone, and the paper does not appear mottled when held up to the light and looked through, then the photograph is properly fixed, and may be placed in a dish of water, previous to a final and more complete washing.

It will be found that prints taken on albumenized paper are much slower in losing the red tint than those on plain papers,—still it is only a question of time.

It is advisable not to carry the toning too far; very beautiful tones can be produced in the “old hypo bath,” but experience shows that when permanence in the prints is an object, the rich blacks and creamy whites caused by a prolonged immersion in the bath must be avoided; the toning must be stopped when the redness of the print is succeeded by a deep brown; beyond this stage the print, however well washed, is liable to fade.

Instead of adding nitrate of silver to the new hypo bath, a better, safer, but not so economical a method, is to substitute chloride of gold—eight grains to the pint, which can be first dissolved in a little water, and then gradually added to the hyposulphite solution; prints take fine tones in this bath, and it

is well adapted for albumenized paper ; both this bath and the other previously mentioned, after much use require to be diluted with water to compensate for waste, and strengthened occasionally by the addition of an ounce or two of the crystals of hyposulphite of soda ; the bath now under notice should have a few grains of chloride of gold (in solution) added to it when its toning power seems to flag.

If the gold toning bath be much used, the nitrate of silver introduced into it from the prints will be objectionable, as being liable to cause the toning independently of the gold ; in this case, it will be well to soak the print for an hour in a pan of clean water, directly that it is removed from the copying-frame, and before it is immersed in the fixing solution.

For portraits on plain paper, perhaps the best plan is to use a toning and a fixing bath separately ; on taking the print from the frame let it be immersed in a pan of water, that the free nitrate of silver may be removed from the surface of the paper ; this should be done in the dark room. After, at least, an hour's soaking, it should be put into a clean dish, with the following solution :—

Distilled water	...	...	...	10 ounces
Sel d'or	...	...	...	8 grains
Pure muriatic acid	...	...	...	5 drops—Mix.

Prints intended to be toned in this solution should be only slightly overprinted. On their immersion in a new bath, they are very rapidly coloured, but as the gold by use is withdrawn, the toning action becomes slower. When the print has attained a pure black and white tone, it may be removed from the bath ;—on no account should it be left in long enough to get blue, for, however well it may look while wet in the colouring bath, it becomes, after fixing and drying, of a dull heavy tone, and possesses no brilliancy. This toning process should not be conducted in a strong light.

On removing the print from the sel d'or bath, place it in a new solution of hypo (about one ounce hypo to five of water), and let it remain until the paper seems clear, when held between the

light and the eyes,—probably about half an hour; then let it be placed in a pan of clean water. About a pint of the hypo fixing solution can be made at a time, and renewed when from twenty to thirty prints have been fixed in it; this is to prevent it attaining colouring properties, which it would do after very many prints had been immersed in it; in the present case it is desired that the toning should be with gold, and not by the decomposition of the hyposulphite of soda; hence the precaution of renewing the solution.

WASHING THE PRINTS.

A GREAT deal has been said and written on the subject of the fading of photographs; it has been clearly proved that, under certain circumstances, they *do* fade, and it has been equally clearly shown that by a proper understanding of the causes and common attention to the requisite precautions, fading need never occur. The causes of fading are three,—overfixing in the old hypo bath, insufficient washing, and improper mounting. We have already pointed out the propriety of withdrawing the prints from the hypo solution before the brown tint has left them; when they have assumed the slightest tinge of yellow in the half tones, there is no chance of their permanence.

The object of washing the prints is to insure the absence of the slightest trace of the hyposulphites of soda and silver; now the hypo although very soluble in water, is most persistent in its adherence to the paper; it is not sufficient simply to immerse them in water; a means must be adopted that shall cause the water to act mechanically on the surfaces, and, as it were, to rub out, as well as soak out, the chemicals.

The quantity of water necessary for washing depends on the number and size of the prints; say that there are a dozen moderate sized pictures, the ordinary method would be to put them all together into a large washing pan or foot-bath, place it under the water-tap, turn it half on, and let it run for a couple

of hours; the prints would then soak for twelve hours in the pan of water, and be again subjected to the running stream for an hour or two, taken out, and hung to dry.

Another method is to place each print on a clean flat board under the water-tap with the stream full on it; having a clean sponge to keep saturating it with the water, and gently dabbing all over the print, doing both sides; prints on plain paper must be dealt tenderly with, or the surface may get rubbed up and the picture spoiled, but the albumenized prints will bear considerable rubbing without injury: having sponged and well sluiced the print for about five minutes, it is placed in a pan of water, the larger the better, and another submitted to the same operation, until they are all well rinsed and sponged; they then soak all together for eight or ten hours, and are again sponged and rinsed on another board, and with another sponge, when they may be considered perfectly washed, and hung by the corners to dry.

There are many plans for washing prints which may suggest themselves to the mind of the amateur; he will be guided by his convenience and the extent of his printing operations, but under any circumstances he must remember never to spare the water; the photographer must believe in, and extensively practise hydro-pathy, or be content to let his creations fade and perish before his eyes.

Paper photographs are generally mounted on card-board, and if paste be used—particularly sour paste—there is a liability to cause fading; gelatine may be used with safety.

HINTS ON PORTRAITURE.

THE position of a sitter, while it has generally the least attention paid to it by the amateur, is really the most important matter in photographic portraiture; be the photograph ever so clear, sharp, and well-balanced in light and shade; ever so beautiful in tone, or correct as a likeness, the production is valueless, unless it be accompanied with a graceful and characteristic *pose*; rules without examples can scarcely afford any assistance, and little more can be done, in a work like the present, than to draw the operator's attention to the subject and to recommend him, if he wish to excel in this branch of the art, to study the many accessible works on art and composition as applied to portraiture.

With a view to their avoidance, a few of the most common enormities may be enumerated:—A stout old gentleman is often placed leaning far back in his chair, and in consequence his portrait represents him as being three times stouter than he is, and graces him with an idiotically small head; he has a hand on each hip, so as to form correct angles on either side, and give him the appearance of a geometrical problem; his body is turned to the left, his head to the right, and his eyes vacantly staring in a direction between the two. Again, a tall, thin lady is made taller and thinner by being taken in a standing position; having a good shaped nose, a full face portrait is “done,” and the outline of the nose lost; having fine eyes she is made to look up, down, or such a direction that their beauty may be lost.

Groups are frequently seen with the sitters forming it, either straggling all over the picture, or else arranged with mathematical precision in a straight line; as if with a desire to emulate the position of the youthful and hilarious butchers of the legend—"all in a row."

The most convenient place in which portraits can be taken, is undoubtedly a glass room, built expressly for the purpose, with blinds and screens fitted to it in such a manner that any desired effect of light and shade can be produced; still very beautiful portraits can be and are made in the open-air, and even in ordinary well-lighted rooms.

A little trouble and expense in procuring a proper background is repaid by the results; a blanket answers well for a light background, but it is rather too light in some cases; a grey head or light cap will seem to sink in the picture taken with it. Green baize backgrounds give great relief to the figure, when it is not darkly draped; but, as a rule, a colour should be chosen, which, by contrast, will not impair either the purity of the whites, nor the depth of the shadows in the portrait.

Screens are indispensable to moderate the intensity of the light, and introduce a proper amount of shadow on parts of the figure; for a portrait taken in the open-air, a screen—which may be a dark table-cover thrown over a clothes-horse—should be placed on one side of the sitter, and nearly at right angles with the background; very delicate shadows can be produced by its aid. Generally open-air portraits have too much top light; causing heavy shadows in the eyes, and under the nose and chin; in such cases the remedy is found by using a dark screen over the head of the sitter, projecting from three to five feet from the top of the background.

When a portrait has to be taken in an ordinary room, it will be found necessary to fix a white or light blue screen in a parallel line with the window, and place the sitter and background in the space between the two, with the light full on the face; the object of the white screen, which may be a sheet, is to throw back a portion of the light from the window on one side of the sitter's

face, which would be too deeply in shadow without some reflected light.

The focus of a portrait lens is very limited in depth; that is, it will not produce sharp and well-defined images of objects, which are at different distances from the camera, if one be in focus, the others will be out; this want of depth increases as the objects are brought nearer to the lens; hence the necessity for placing the sitter with care, that the hands and face may be on the same plane, and that no part of the arrangement may project towards, or recede very greatly from, the camera; not only will those parts be indistinct, from being out of focus, but they will also appear much distorted.

The colour of the background and dresses of the sitter greatly influences the time of exposure in the camera; a plate which would require thirty seconds exposure, if the background were very dark and the sitter clad in black, would, in the same light, be over-exposed in twenty seconds with a light ground, and light coloured drapery; now a light colour, in a photographic point of view, is not always what is commonly considered a light colour; yellow is light, but yellows scarcely have any effect on the most sensitive plate, and the result is black; reds are very nearly as dark, but blue, even when deep in tone, produces an effect almost identical with white. It being understood that yellow and red draperies develop darker, and blues lighter than they really are, and that these three colours are components of all other colours, it is then easy to judge the effect of any compound colour; for instance, light green and purple produce medium tints, unless the yellow in the former, and the red in the latter, be in excess, in which cases the results will be dark.

Head-rests are highly useful, when properly managed; the most simple form of rest can be screwed on the back of a chair and easily adapted to the position of the sitter; it should be fastened without pushing the head forward, or otherwise giving the sitter an awkward and constrained appearance.

The portrait camera should be kept in good condition, dusted out occasionally, and examined as to its being light-tight; the

lenses will also require attention and careful polishing with wash-leather.

The camera, when in use, must be carefully screened from sunlight with the focussing cloth; when the dark frame, carrying the prepared plate, is inserted in the camera, the cloth can be thrown over it, and the slide drawn up under the cloth, to prevent any light finding its way to the plate, through the crevice in which the slide moves.

Sunlight falling on the lenses, causes fogging on the lower half of the plate; the face of the sitter may be brought out clearly, but the lower part of the figure will be in a mist; to prevent this disagreeable effect, the sun must be screened from the lenses, either by a dark blind above, or an addition in length to the front of the brass tube; a card-board or tin tube, about three inches long and blackened inside, can be made to fit over the brass, and draw in or out, as far as may be required, to shield the lenses from the glare of light.

OUT-DOOR PHOTOGRAPHY.

THE old calotype and wax-paper process, each have their supporters in a claim for superiority over the collodion process in open-air operations; they certainly have an advantage in the ease of the manipulations, and the small quantity of apparatus which the operator requires to carry with him in a photographic campaign; but, as he does not develop his picture on the spot where it has been taken, he is never certain of a good result, and can only discover a failure on his return home, when he may be miles from the coveted view; add to this a consideration of the want of sharpness and half tone observable in most paper negatives, and the amateur will not hesitate to adopt the more troublesome, but, in most respects, more satisfactory, negative collodion process for views as well as portraits.

Cameras for views are made in a variety of forms, the best are those which combine portability with firmness; stability and a degree of weight proportionate to its size, are necessary to prevent a camera from being moved or blown over by a puff of wind; the same remark applies to the camera-stand. For views above four inches square, a single achromatic lens is used, but for sizes less than this, such as stereoscopic views, the double arrangement, or what is called the quarter plate portrait lens, answers as well, if not better.

As the plate, in the ordinary collodion process, requires to be coated, excited, exposed, developed, and fixed, all within about half an hour, and the operations performed in the dark, it is

evident that the photographer must carry his dark room with him: portable dark tents are procurable, in which the manipulations can be made almost as easily and surely abroad, as in the most conveniently arranged dark room at home.

Having pitched the tent, arranged the apparatus required to be used in it, and focussed the view, the operator proceeds to take it in the same manner, with a few exceptions, as recommended for portraiture. The exceptions—only two—are most important; the collodion must generally be old, and the use of the diaphragm must be well understood.

The finest views are doubtless taken in bright weather, with collodion iodized, at least, a month before using; it is slow in its action, sometimes requiring three or four minutes exposure, but the delay is fully compensated for, by the improved results; when instantaneous views are required, freshly iodized collodion must be employed, at the risk of fogging and heavy pictures.

All view lenses are provided with diaphragms or stops; these are circular pieces of blackened metal, which fit into the front of the lens-tube, they have openings of different sizes in the centre, so that when fastened in the tube the whole of the lens may be covered, except a spot in the middle; these openings generally range from a quarter of an inch to an inch and a half in diameter, their use is to diminish the amount of light entering the camera; a certain quantity only is required to bring about the desired change on the sensitive plate, and it is found that the more this portion of light is confined to the centre of the lens, the better will be the effect; the smaller the central opening in front of a lens, the more brilliant and distinct will be the picture, not only at one point, but all over it. The size of the diaphragm used with the lens, must be regulated entirely by the illumination of the view; the more powerful the light the smaller should be the stop employed.

Satisfactory views cannot be taken on a misty day, but dull weather is not objectionable, if the atmosphere be clear; in such a case a medium sized stop should be used, and the time of

exposure lengthened, but not greatly; more negatives of views are spoiled by over than under exposure.

A great advantage of the ordinary collodion process, is in the fact that one is speedily made acquainted with the result; if a failure, another can at once be taken; its principal objection is found in the necessity for taking so much apparatus into the field; many photographers, impressed with the inconvenience, choose one of the many processes which will allow them to take out in the morning a number of prepared plates, expose them when desired, and develop them in the evening, or on the next day; boxes, bottles, tents, &c., are then not needed, and all that is required is to make as sure as possible that the exposure of the plate is properly timed.

From several methods which allow a lengthened period to elapse between sensitizing the plate and developing the image, we select that of M. Taupenot, as giving generally the most certain results; this without prejudice to other dry or preservative processes, which may at present be considered promising but imperfect.

The plate has to be cleaned and coated with negative collodion in the usual manner, and afterward excited in the negative silver bath. On removing the plate from the silver bath, wash the film thoroughly by pouring over it some distilled water, which removes the excess of nitrate of silver; now pour on the film a quantity of iodized albumen, sufficient to cover it; tilt up one corner of the plate, and allow the small excess of albumen to return to the bottle in which it is kept.

The iodized albumen is made as follows:—Take any quantity of the white of fresh eggs, and to every fluid ounce add ten grains of iodide of potassium; beat the whole of it into a froth, and allow it to settle for twenty-four hours; filter through linen, and it is fit for use.

A number of plates should be coated at one time, placed in the dark, and leaning against a wall to dry; great care should be taken that they are well screened from dust. These plates will take several hours to dry, unless heated by a spirit-lamp, or

before a fire; they are very slightly, if at all sensitive to light, and may be kept for months without injury.

To excite a collodio-albumenized plate, plunge it into a silver bath kept for that purpose only, and made as follows:—Sufficient distilled water nearly to fill the gutta percha bath, to every ounce of water 50 grains nitrate of silver and one fluid drachm of acetic acid. Let the plate remain in the bath for two or three minutes, then remove it, and wash lightly with distilled or filtered rain-water: the more perfect the washing, the longer the plate will remain in good condition, but the longer will be the required exposure in the camera; for a plate which has to be used within twenty-four hours of being excited, half-a-pint of water will be an ample supply for washing a medium sized plate.

The plate is now highly sensitive to light; place it vertically in a dark place, and allow it to dry spontaneously. A number of plates can be prepared in the same manner, and when dry, used immediately, or kept for several days, or even weeks if they have been thoroughly washed after their first and second immersions in the silver bath. They can each be kept in a separate dark slide, fitting to the camera, or, what is better, carried (a number together) to the scene of operations in a light-tight grooved box; in the latter case, the operator must provide himself with a black bag, into which he can introduce his arms, the box of plates, and the dark slide, to enable him to fix a sensitive plate in the slide for use in the first place, and, after exposure, to withdraw it and replace it with another. The bag must be provided with two elastic arm-holes, and made in other respects perfectly light-tight. Very little difficulty will be found in changing the plates in a bag of this description—nothing more is required than a little method; the exposed plates being placed by themselves at one end of the grooved dark box, and the excited plates at the other, with the coated sides all turned in one direction. Expose in the camera for about double the time required in the ordinary wet process.

On returning home with a box full of exposed plates, they may either be developed at once, or put by until the first

convenient opportunity, within a few days, according to the previous preparation.

Perhaps the best way to develop these negatives, is to use the ordinary pyrogallic developing solution first, then, after a minute or two, to pour it back into the measure, and pour on the film, from another glass, a little of the silver-bath solution, diluted with twice its own bulk of distilled water; return the nitrate to its glass measure, and again pour on the pyrogallic; keep repeating the process, alternately using the pyrogallic and the silver, until the picture is properly developed, which may be in from ten to fifteen minutes.

After well washing the developed picture, fix it by immersion in a shallow dish containing a solution of hyposulphite of soda—about three ounces to the pint of water; in a few minutes the yellow iodide will have been cleared from the film; the plate can then be removed from the hypo, washed, dried, and varnished in the same manner as are ordinary collodion negatives.

STEREOSCOPIC PHOTOGRAPHY.

WE have no intention of entering into an account of the laws of binocular vision, or their application to the stereoscope; our duty lies rather with the practical, than the theoretical, and in giving simple instructions for producing stereoscopic pictures, we attempt no more than our task imposes.

For use in Sir David Brewster's lenticular stereoscope, there are required a pair of pictures identical in subject, and differing only in one respect—the visual angle: one photograph should faithfully represent the object as seen with the right eye, and the other the same object as seen with the left eye; the optical arrangement of the stereoscope combines these two one-eyed views, and gives the marvellous effect of a perfectly solid reproduction of the original,—a single picture, or rather model, of the object as viewed with both eyes at once.

The taking of such right-eyed and left-eyed photographs, is obviously simple enough; by placing two cameras of equal sizes, and focal lengths, opposite to the object, and at a distance equal to that between the eyes (about two and a half inches), the views thrown on the ground-glasses must necessarily represent the two dissimilar pictures required for the stereoscope; and by manipulating with collodionized glasses, in the ordinary way, they can be secured.

It is very important, when two cameras are used, that the lenses should be of exactly the same focal length, otherwise the images photographed will not be of the same size, and will not be suitable for the stereoscope; the apertures of the lenses should also

be equal ; and, in short, the conditions of the plates, exposure, &c., should be precisely the same for both cameras. But there is another method, by which an extra camera is not required ; a dark slide, made for the purpose, is attached to the back of a small sized camera, and into this slide can be fitted a long narrow plate of glass, sufficiently large to take in, side by side, the two dissimilar views ; a very simple arrangement allows one-half only of the plate to be exposed at one time ; so, having focussed the right-hand view, half of the sensitive plate is first impressed ; then the cap placed on the lens ; the camera is now moved $2\frac{1}{2}$ inches to the left, and the slide shifted, that the unexposed half of the plate may be brought into position ; the cap is then again removed, and the left view taken. This is a very convenient arrangement, and one generally adopted for views, but for portraits, or in other cases where the exposure must not occupy much time, two cameras are preferable.

In using two cameras, it will be necessary slightly to incline them inwards, at such an angle that the pictures on the ground-glasses shall each include the same objects ; to ensure this, a line can be drawn longitudinally down the centre of each ground-glass, and, in focussing, care taken that the object which is on or near the line in one camera, shall occupy the same position in the other. It is equally necessary with the single camera, that the two pictures produced in it should be taken at an inclination towards the same point ; and for the purpose of facilitating the angular arrangements, many ingenious plans have been devised ; perhaps the best is one where the camera is attached to two sliding bars, which allow a rapid and exact movement of the camera left and right, with the required inclination to a common centre.

There exists a great difference of opinion among photographers as to the proper distance at which the cameras should be placed, the one from the other : theorists cannot discover a single reason why the distance between the eyes should not be taken as a standard, and never, under any circumstances, departed from ; for it is evident, that a stereoscopic view, the two pictures of

which were taken three or four feet asunder, can hardly be a correct copy of the scene, as viewed by ordinary eyes placed in the ordinary position; such a view, however wonderful for its great relief and apparent solidity, appears rather as a copy of a cardboard model of nature, than a transcript of nature itself. Portraits taken with the instruments placed far apart, produce monstrous effects—noses and necks of unnatural lengths, and other distortions, equally offensive to truth and good taste. Notwithstanding all this, in practice it is found necessary—in order to produce a striking stereoscopic effect—to depart from the rule, and frequently to exceed two and a half inches, as the distance between the two cameras, or the two positions of one shifting camera. The greater the distance from the object, the greater may be the distance between the cameras; at a distance of ten feet from the object, the cameras may be placed three inches apart—measuring from one lens-tube to the other; at fifteen feet from the object, the cameras may be four inches asunder, and for every additional five feet, an inch added to the distance between the cameras; but stopping when the separation amounts to eighteen inches. This is, at least, a safe arrangement, and without being scrupulously exact, the operator who is guided by it will not fail to get a satisfactory stereoscopic result.

The beauties of stereoscopic photographs are so well appreciated, that it is almost unnecessary to speak a word in their favour; yet we cannot refrain from directing attention to the ease with which the photographer can secure these miniature reflections of nature; portable sets of apparatus are made, specially for stereoscopic views; the camera, chemicals, &c., pack into a small knapsack, and the tent folds up into a compass little larger than that of a gig umbrella, and is of much less weight; the amateur, who is familiar with the collodion process, by the aid of this convenient, light, and highly portable apparatus, is enabled to furnish his stereoscope with a variety of views, the beauties and truth of which far exceed the largest and finest productions of the photographer, who, in search of the gigantic, may bring his apparatus to the field by horse loads.

SOLUTIONS USED IN THE COLLODION PROCESSES.

THE safest and most economical course for the amateur to pursue, in the matter of chemical solutions required in the art, is to purchase at a respectable house a small stock ready mixed; he will then have to contend only with difficulties purely photographic; adding to these difficulties a number of delicate chemical manipulations, is to increase fourfold the impediments to success; these remarks apply more especially to the manufacture of collodion, which should not be attempted until considerable progress is made.

In weighing crystals and powders, a piece of clean white paper should be placed in each scale-pan, of equal size, that one may balance the other, and fresh paper used at every change of the chemicals weighed; this is to prevent the possibility of a minute portion of one chemical being mixed up with another; an unperceived atom of pyrogallic acid or sulphate of iron left in the scale-pan might find its way, with some nitrate of silver, into the silver bath and ruin it. Glass measures should be cleaned before and after using, and, if possible, kept for a certain distinct purpose; for instance, a small graduated measure should be kept for iodizing the collodion, and never put to any other use; bottles in which developing, fixing, and silver solutions are stored, should never be changed, the one for the other, even their stoppers or corks must not be mistaken and misapplied.

The fingers must be well looked after, not on account of inevitable black stains, which, to a properly developed photographer is a trifle, but because they are apt to come into contact with the hypo, and afterwards carry decomposition to the silver solutions. If blackened fingers be objectionable, the stains can be removed by rubbing them with a lump of moistened cyanide of potassium.

The silver baths, and some other solutions, occasionally require to be filtered; it is best done by folding a square piece of filtering paper twice, in such a manner that, by partly opening the folded paper, a cone may be formed, which can fit into a funnel, and allow the solution to filter through the paper.

Silver solutions, which have had albumenized papers or glasses in them, rapidly become discoloured, and no amount of filtering will clear them; the colour can be removed by mixing with the solutions some powdered china clay,—about one ounce to the pint, the mixture should be well shaken up, and afterwards put by, to allow the powder to settle, when the solution will be found quite clear and colourless.

In the following, as also in any preceding, formulæ, when speaking of fluids, it is supposed that the liquid is measured not weighed, and in every instance where weights of crystals and powders are mentioned, the troy ounce (480 grains), drachm (60 grains), or scruple (20 grains), is intended to be used.

COLLODION.

To prepare the soluble cotton, put into a basin or mortar, 520 grains of pure nitrate of potash, and reduce it, by rubbing, into a fine powder; then moisten it with a drachm of water, and afterwards add two measured ounces of pure sulphuric acid, well stirring the mixture with a glass rod; then 30 grains of the finest cotton wool should be quickly immersed in it, a few fibres at a time; again stir up the mixture for about five minutes, taking care that every particle of the cotton is wetted by the

pasty solution ; now fill up the vessel with water, and quickly pour off the clear portion of the fluid ; repeat this several times, and then take out the cotton and well wash it in a large quantity of water, using a glass rod or paper knife to save the fingers from the effects of the acid. Every trace of acid must be removed from the gun cotton, and if, after long washing, the taste give evidence of acidity, the cotton may be soaked in warm water, frequently changed, for an hour or two.

When thoroughly washed, put the cotton into a clean dry towel and wring out as much as possible of the moisture, then pull the fibres out loosely, and put it in a warm place to dry, not a *hot* place, or the gun cotton may explode ; when perfectly dry, it may be placed in a dry stoppered bottle, and preserved for use.

It will be necessary to make the soluble cotton in the open air ; as the noxious fumes of the acid mixture are exceedingly unpleasant, if not injurious, in a confined space. The first washings of the cotton should be very quickly done, and care taken that the corrosive acid does not splash over the operator.

To five ounces of pure sulphuric ether, add two ounces of absolute alcohol, shake it up, and dissolve in it about 30 grains of the soluble cotton ; it may be added a few grains at a time, and the mixture thoroughly shaken ; it should then be kept undisturbed for a day or two, to allow any undissolved cotton to settle to the bottom of the bottle.

SOLUTIONS FOR GLASS POSITIVES.

IODIZED COLLODION.—The iodizing solution is made by dissolving 24 grains of iodide of ammonium, and 4 grains of bromide of ammonium in an ounce of spirits of wine ; to seven drachms of the plain collodion, add one drachm of this solution, shake it up, and the positive iodized collodion is ready for use.

SILVER BATH.—Dissolve 25 grains of nitrate of silver in two drachms of distilled water ; in another vessel, dissolve half a grain

of iodide of potassium in two or three drops of water, and add it to the silver solution; in an hour, put six drachms of distilled water to the silver and iodide mixture, and well stir it up; let this stand for three or four hours, and then filter it through bibulous paper; with the clear filtered solution mix eight drops of alcohol, and half a minim of glacial acetic acid. This will make only one ounce of the silver bath; for a greater quantity multiply all the proportions equally, and proceed in the same manner.

DEVELOPING SOLUTION.

Sulphate of Iron ...	15 grains	} Dissolved in one ounce of distilled water.
Glacial Acetic Acid ...	15 minims	
Alcohol	10 minims	

This solution will give chalk-like whites on the positives; when a metallic appearance is desired, it can be produced by lessening the amount of acetic acid and substituting nitric acid; instead of 15 minims of acetic acid to the ounce, use 10, and from half a minim to one minim of nitric acid.

FIXING SOLUTION.—Dissolve 40 grains of cyanide of potassium in 10 ounces of water. The cyanides are highly poisonous, as are also most of the chemicals used by the photographer; care should therefore be taken that they do not come in the way of children, or persons ignorant of their dangerous properties.

NEGATIVE SOLUTIONS.

IODIZED COLLODION.—Dissolve 30 grains of iodide of ammonium in one ounce of alcohol; this is the negative iodizing solution—it requires to be filtered before using. To make one ounce of negative collodion, add one drachm of the iodizing solution to seven drachms of the plain collodion, and well agitate the mixture.

SILVER BATH.—In two drachms of distilled water dissolve 35 grains of nitrate of silver, and add to the solution, about half a grain of iodide of potassium, dissolve in a few drops of water; iodide of silver will be precipitated at first, but afterwards dissolved

by the strong solution of silver; in an hour or two, make up the quantity to one ounce, by the addition of distilled water, again iodide of silver will be precipitated. In a few hours the solution may be filtered, and five drops of each, alcohol and sulphuric ether, added to it, when it will be ready for use.

No one will be likely to conduct photographic operations on so lilliputian a scale, that only one ounce of the silver bath would be required; we give directions for making one ounce, but one gallon can be made in the same manner, by increasing all the quantities.

DEVELOPING SOLUTION.

Pyrogallie Acid	...	1½ grain	} Dissolve in one ounce of distilled water.
Glacial Acetic Acid	...	8 minims	
Spirits of Wine	...	10 minims	

The solution will keep well for at least a fortnight, but acts better when freshly mixed.

FIXING SOLUTION.—The same as for positives, but it will not hurt if stronger, say from five to ten grains of cyanide of potassium to the ounce of water. Many operators prefer hyposulphite of soda for fixing negatives; it is best used by dissolving four ounces of hyposulphite in eight ounces of water; the solution is kept in a dish, and, after developing, and washing, the plate is immersed in the dish, and removed when the yellow iodide is cleared from the film. The hypo fixing can be used again and again, until it becomes too weak for use.

In the preceding pages much useful, although theoretical, information has been necessarily omitted, rather from a fear of rendering so elementary a work uninteresting and unintelligible, than from a want of due appreciation of its importance. But the student who, having mastered his "A B C," still thirsts for photographic knowledge, may fully satisfy his cravings by consulting Hardwich on Photographic Chemistry, Brewster on Optics, the Prize Essay on the Stereoscope, and the monthly numbers of the Journal of the Photographic Society.

WEIGHTS AND MEASURES.

TROY WEIGHT.

Pound .....	℔.	.....	12 ounces.
Ounce .....	℥	.....	8 drachms.
Drachm ...	ʒ	.....	3 scruples.
Scruple ...	ʒ	.....	20 grains.
Grain	gr.	.....	1 grain.

480.0 grains Troy.....	1 ounce Troy.
437.5 "	1 " Avoirdupois.
7000.0 "	1 lb. Avoirdupois.
5760.0 "	1 lb. Troy.

ENGLISH MEASURE.

Gallon, <i>Congius</i>	8 pints
Pint, <i>Octarius</i>	20 fluid ounces.
Fluid Ounce, <i>f. ℥</i>	8 fluid drachms.
Fluid Drachms, <i>f. ʒ</i>	60 minims.
Minim, <i>m.</i>	1 minim.

FRENCH WEIGHTS AND MEASURES.

	English Grains.
The Gramme.....	15.4340
" Decigramme	1.5434
" Centigramme	0.1543
" Milligramme	0.0154

The Kilogramme equals nearly 2 lbs. 3 oz. $4\frac{1}{2}$ drachms Avoirdupois.
 The Litre is equal to about $1\frac{3}{4}$ pint imperial (*i.e.*) 35 oz.

The following table gives the approximate values of the various units of weight and measure in the metric system, compared with the corresponding units in the British system. The units in the metric system are given in the first column, and the corresponding units in the British system are given in the second column. The units in the metric system are given in the first column, and the corresponding units in the British system are given in the second column.

1 gram	1 grain
10 grams	154 grains
100 grams	1543 grains
1 kilogram	15432 grains
10 kilograms	154320 grains
100 kilograms	1543200 grains
1 tonne	15432000 grains

1 litre	1.056 quarts
10 litres	10.56 quarts
100 litres	105.6 quarts
1000 litres	1056 quarts
10000 litres	10560 quarts
100000 litres	105600 quarts
1000000 litres	1056000 quarts

1 cubic centimetre	1.056 cubic inches
10 cubic centimetres	10.56 cubic inches
100 cubic centimetres	105.6 cubic inches
1000 cubic centimetres	1056 cubic inches
10000 cubic centimetres	10560 cubic inches
100000 cubic centimetres	105600 cubic inches
1000000 cubic centimetres	1056000 cubic inches

1 cubic metre	35.237 cubic feet
10 cubic metres	352.37 cubic feet
100 cubic metres	3523.7 cubic feet
1000 cubic metres	35237 cubic feet
10000 cubic metres	352370 cubic feet
100000 cubic metres	3523700 cubic feet
1000000 cubic metres	35237000 cubic feet

1 cubic decimetre	1.056 cubic inches
10 cubic decimetres	10.56 cubic inches
100 cubic decimetres	105.6 cubic inches
1000 cubic decimetres	1056 cubic inches
10000 cubic decimetres	10560 cubic inches
100000 cubic decimetres	105600 cubic inches
1000000 cubic decimetres	1056000 cubic inches

The following table gives the approximate values of the various units of weight and measure in the metric system, compared with the corresponding units in the British system. The units in the metric system are given in the first column, and the corresponding units in the British system are given in the second column. The units in the metric system are given in the first column, and the corresponding units in the British system are given in the second column.